Introduction to Information Science and Technology

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CHAPTER 1

Our World of Information

1.1. How Much Information?

Information is everywhere and in huge amounts. How much is there (can we find out)? Where does it come from? And how does all that information affect us as individuals? What can we do to find out what it's worth while providing some level of organization and control? This introductory chapter places each of us, as information producers and users, into the big picture.

In 2008, researchers Roger Bohn and James Short at the University of California–San Diego's Global Information Industry Center asked "How much information was consumed by individuals in the United States?" (2009, p. 8). They looked at only nonwork use of information, such as watching television or talking on a cell phone. Among their conclusions are the following:

- Each American spends, on average, half of each day of (11.8 hours) consuming information.
- Although we spend 41 percent of our "information time" in front of the TV, TV provides less than 35 percent of the bytes of information we consume.
- Computer and video games, because of their graphics, account for 55 percent of the information bytes we consume at home.
- Altogether, we gobbled up some 3.6 zettabytes of information at home in 2008.

How much is a zettabyte? It is 10^{21} bytes, or 1,000 exabytes. Bohn and Short (2009, p. 8) estimate that an exabyte, or 1 billion gigabytes, is the capacity of all the hard disks in home computers in Minnesota (population 5.1 million). So the nonwork information consumed in the U.S. in 2008 was equal to what could be stored on 3,600 Minnesotas' worth of hard drives. In other words, if all this information were "printed … in books and stacked … as tightly as possible across the United States including Alaska, the pile would be 7 feet high" (p. 13). Bohn and Short also found that radio is "a highly byte-efficient delivery mechanism." People listened to radio for 19 percent of their hours spent consuming information—this amounted to 10.6 percent of daily words received but only 0.3 percent of the total bytes of information received (p. 9).

In the 1980s, Ithiel de Sola Pool and his colleagues investigated the growth of information (measured in words) supplied by the media in the U.S. and Japan (Neuman & Pool, 1986; Pool, 1983; Pool, Inose, Takasaki, & Hurwitz, 1984). They analyzed the number of words supplied and consumed as well as the average price per word. They reported that available information was shifting from print to electronic media, the price per word was falling dramatically, and although the rate of consumption was increasing (at 3.3 percent per year), it was falling ever further behind the amount of information supplied. These findings have implications for information overload, information diversity, and the economics necessary to sustain vibrant, creative industries in journalism and popular and high culture.

Neuman, Park, and Panek (2010) extended Pool's work to cover the period from 1960 through 2005. They found a tremendous increase in the ratio of supply to demand. In 1960, 98 minutes of media were available for every 1 minute of media consumed: Choices had to be made, but the number of choices was within reason. By 2005, more than 20,000 minutes of mediated content were available for every minute consumed. This, they point out, "is *not* a human-scale cognitive challenge; it is one in which humans will inevitably turn to the increasingly intelligent digital technologies that created the abundance in the first place for help in sorting it out—search engines, TiVo's recommendation systems, collaborative filters" (p. 11). Neuman and colleagues also found a change from *push* to *pull* technologies: Traditional, one-way broadcast and publishing media push content, with the audience accepting the decisions of newspaper editors and network executives. Today, technologies are evolving to pull in audience members, who have more choice and more control than ever before over what they watch and read, and when. Search engines (especially Google) and social networking sites (e.g., YouTube, Facebook) are emerging as major influences on public opinion and popular culture.

1.2. Where Does Information Come From?

Philosopher Karl Popper (1979) found it useful to use a metaphor of three "worlds" to describe how knowledge exists and develops:

- World 1: the physical world
- World 2: subjective reality (how we see or experience the world)
- World 3: objective knowledge (accumulated and scientific knowledge)

Science, Popper says, is a process that takes place in all three worlds: In World 1, events happen; in World 2, we try to make sense of them; and in

World 3, we try to explain the events while others react to these explanations and try to improve on them. Thus, we bring the three worlds together to create information (or awareness) through a never-ending process that produces knowledge. Along the way we create tools and technologies that help this process.

To take a less philosophical, more practical view, information reaches us from records of historical events, scientific knowledge, religious or cultural knowledge, art and literature, personal knowledge and records, documentation of governments or organizations, business, commerce, and many other sources.

Information may arrive prepackaged from a variety of sources. Publishers, government agencies, and other organizations produce formal products such as books, journals, and databases. Individuals package information in email, blogs, wikis, and other forms. Various institutions handle these packages. Libraries customarily deal with books, journals, video and audio recordings, microforms, databases, and even manuscripts, papyri, and clay tablets. Archives typically house governmental records, personal papers, and manuscripts. Databases (some commercially compiled and others available for free on the internet) also provide access to books, journals, webpages, blogs, videos, and other sources.

All of these various "packages" of information can be considered to be information systems (micro and macro) created to achieve some purpose. They may also be considered to be (micro and macro) communications systems, so that the information in them can be satisfactorily transferred: from the package to someone who wants the information or from one package to another package. However, all communications systems have potential problems. Information science seeks to analyze, design, and evaluate these systems in order to understand and improve how they function.

1.3. The Effects: Information Overload

The world is filled with information, and we acquire it in various ways:

1. We discover it through our physical, mental, and emotional senses.
2. We seek it by asking questions and searching for it.
3. We obtain it through feedback from other people and from various types of information systems.
4. We organize it (in our heads and in our files) and may make new information.

For centuries people have noted (or complained) that there is too much information in the world. In 1755 French encyclopedist Denis Diderot wrote

that the increase in published material would eventually make it easier to rediscover facts from observing nature than to find information "hidden away in an immense multitude of bound volumes" (Diderot, 1975/1755, pp. 234–235). Alvin Toffler (1970) described the technological and structural changes in society in his book *Future Shock*, which helped to popularize the term *information overload*, meaning having so much information that it is difficult to set priorities or make decisions. Richard Saul Wurman (1989) observed that people respond with *information anxiety* to this inability to cope with the perceived flood of information.

Consider the ideas of information overload and information anxiety on a personal level. Thinking historically, compare the amount of information (and the systems for accessing that information) available to you today for succeeding in college or finding a job with that available to your parents and your grandparents. Are you, your family, and your country better off (financially, psychologically, or in other ways) because you can know almost instantly what is happening around the world (say in Baghdad, Moscow, or Mumbai)?

1.4. Evaluating Information

As we attempt to screen information and reduce the amount with which we must contend, we ask two basic questions about information: its value (what is it worth?) and its quality (is it any good?). Ultimately, the value estimation must be considered in light of the cost of the information, which brings us to the familiar question of the relation between costs and benefits.

Calculating a cost-benefit ratio is not easy because there are many aspects of cost and because the notion of benefit may be difficult to assess. Costs are typically of two types. Fixed costs, which are moderately easy to determine, include labor (salaries), equipment, supplies, and software. Variable costs are more difficult to determine. Examples include delays by others involved, unexpected breakdowns (for whatever reason), and mistakes or errors. On the other side of the cost-benefit ratio, the following questions can be used to determine the benefit of information or an information system:

1. Did it save time?
2. Did it enhance effectiveness?
3. Did it give us an advantage over the competition?
4. Did it save money in the short run and the long run?
5. Did it help avoid costs of some type?

Quality is the second aspect we consider in evaluating information. Information scientists often consider the following factors in order to determine the quality of information:

- Accuracy
- Timeliness
- Age and obsolescence
- Completeness
- Source availability and ease of use
- Ease of understanding
- Trustworthiness of source

From the perspective of the legal research service Virtual Chase (2008a), the following criteria are valuable for assessing the quality of information:

- Scope of coverage: Is it inclusive or limited?
- Authority: Who said it?
- Objectivity: Is it limited or is there no bias?
- Accuracy: Has it been checked or verified?
- Timeliness: Is it out of date or up-to-date?

Evaluating information quality is especially important for web-based information. Useful steps identified by Virtual Chase (2008b) include the following:

1. Identify and check the source.
2. Discover the source's expertise.
3. Determine the level of objectivity.
4. Establish the date of publication.
5. Verify factual statements.

It is usually much easier to evaluate so-called factual information than subjective (opinion-based) information.

1.5. Managing Your Information

We are said to be living in an information society—even though historians disagree as to when it began and definitions of information vary. We can easily

see some impacts of information on society (such as information overload, described in section 1.3), but others are hard to identify. We cannot say what the economic impacts of information are because we have trouble differentiating an information worker from a noninformation worker. This complication holds for many products today: Which are information intensive and which are not? Even if it is difficult to define, the notion of an information society is so common that we need at least a brief list of its major characteristics:

- Major changes occur in information technologies.
- Large portions of the economy deal with information.
- Many occupations now are information intensive.
- Information networks are a major feature of our lives.
- Information available for our use is extensive—and continually growing.

Who manages this information? Information professionals! And who are they? Their professional titles include database managers, webmasters, information systems staff, librarians, systems librarians, records managers, archivists, and many more.

What happens to information after it is created? A large portion is destroyed (by plan), such as online course materials that are removed after a specified time. Quite a bit of electronic information self-destructs, such as the data we generate while playing a video game. Some information is saved in archives (which may be personal, corporate, or governmental), and some is stored in libraries (and may eventually be destroyed or discarded). The web retains some information; for example, the Internet Archive's Wayback Machine (www.archive.org) shows earlier versions of websites. And some information is destroyed.

What can you do about the impact information has on you? Some options include managing it better; using new technologies to improve your control; creating better indexes, classification systems, and archival systems; and just getting rid of the information you no longer need.

References

Bohn, R. E., & Short, J. E. (2009). *How much information? 2009 report on American consumers.* San Diego, CA: Global Information Industry Center, University of California–San Diego. Retrieved November 11, 2010, from hmi.ucsd.edu/pdf/HMI_2009_ConsumerReport_Dec9_2009.pdf.

Diderot, D. (1975–1995). Encyclopédie. In *Oeuvres complètes* (H. Dieckmann et al., Eds.) (vol. 7, pp. 174–262). Paris: Hermann. Original work published in 1755.

Neuman, W. R., Park, Y. J., & Panek, E. (2010). *Tracking the flow of information into the home: An empirical assessment of the digital revolution in the U.S. from 1960–2005.* Ann Arbor, MI: University of Michigan. Retrieved November 11, 2010, from www.wrneuman.com/Flow_of_Information.pdf.

Neuman, W. R., & Pool, I. S. (1986). The flow of communications into the home. In S. Ball-Rokeach & M. Cantor (Eds.), *Media, audience and social structure* (pp. 71–86). Beverly Hills, CA: Sage.

Pool, I. S. (1983). Tracking the flow of information. *Science*, *211*, 609–613.

Pool, I. S., Inose, H., Takasaki, N., & Hurwitz, R. (1984). *Communications flows: A census in the United States and Japan.* Amsterdam: Elsevier North Holland.

Popper, K. (1979). *Objective knowledge: An evolutionary approach* (rev. ed.). New York: Oxford University Press.

Toffler, A. (1970). *Future shock.* New York: Random House.

Virtual Chase. (2008a). *Criteria for quality of information*. Retrieved November 11, 2010, from virtualchase.justia.com/quality-criteria-checklist.

Virtual Chase. (2008b). *How to evaluate information—Checklist*. Retrieved November 11, 2010, from virtualchase.justia.com/how-evaluate-information-checklist.

Wurman, R. S. (1989). *Information anxiety.* New York: Doubleday.